ACC NR: AM6032638 (A) Monograph UR/

Krishtal, Mikhail Aronovich; Mirkin, Iosif L'vovich

Creep and fracture of alloys (Polzuchest' i razrusheniye splavov) Moscow, Izd-vo "Metallurgiya," 1966. 190 p. illus., biblio. 5,000 copies printed.

TOPIC TAGS: iron alloy, lattice defect, dislocation migration, creep mechanism, alloy creep mechanism, metal heat treatment, alloy heat treatment, heat resistant material

PURPOSE AND COVERAGE: This book is intended for scientific workers and engineers concerned with special alloys, and also for engineers specializing in metal and alloy heat treatment. The book contains information on the changes in the structures and properties of alloys, particularly of iron alloys, induced by prolonged use at high temperatures and stresses. The problem discussed appears to be of considerable importance inasmuch as it is connected with theory and practices adopted for the use of heat-resistant materials in power-machine building, aircraft and rocket production, and in some other branches of industry. Different creep mechanisms specific for prolonged use of alloys at various levels of temperature and stress are compared and respective quantitative kinetic principles are discussed. Publications dealing with the change in the structure and properties of alloys under the affect of prolonged use for

Card 1/4 UDC: 669.011.7

many thousand hours are summarized, and ways of selecting the proper alloying elements and structure of iron alloys suitable for work at high temperatures and stresses are indicated. The authors thank Professor A. A. Zhukovitskiy for his valuable comments.

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ACC NR: A 32 3

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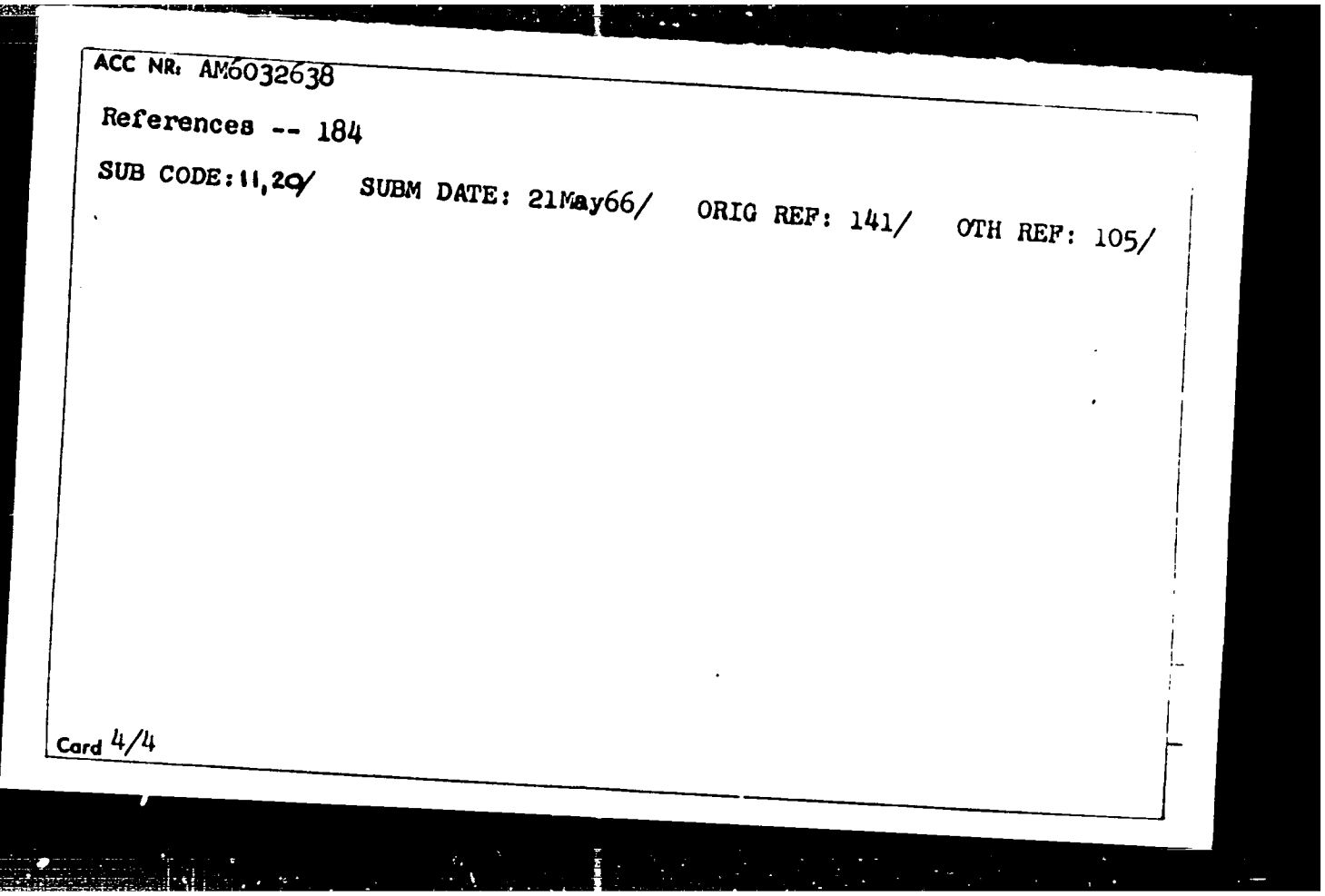

ACC NR: AM6032638

References -- 184

SUB CODE: 11,20/ SUBM DATE: 21May66/ ORIG REF: 141/ OTH REF: 105/

Card 4/4

L 08073-67 EWT(m)/EWP(t)/ETI IJP(c) JD/JG
ACC NR: AP6034191 (A) SOURCE CODE: UR/0369/66/002/005/0518/0521

AUTHOR: Mirkin, L. I.

ORG: Scientific Research Institute of Mechanics, Moscow State University (Nauchno-issledovatel'skiy institut mekhaniki Moskovskogo gosudarstvennogo universiteta)

TITLE: Spreading of gallium over tin surfaces

SOURCE: Fiziko-khimicheskaya mekhanika materialov, v. 2, no. 5, 1966, 518-521

TOPIC TAGS: tin, gallium, liquid metal, ~~liquid gallium tin interaction~~, ~~gallium-wetted tin~~, gallium metal diffusion, ~~tin-gallium~~ solid solution

ABSTRACT: Liquid gallium droplets were applied on the surface of coarse-grained specimens of 99.99-pure tin and their behavior was studied. It was found that at 60—70C, gallium spreads over the solid tin surface and forms a zone of tin-gallium solid solution around the droplet. The rate of spreading is low and, in most cases, is under $1 \cdot 10^{-6}$ mm/min. Within a few minutes after gallium application, the rate of propagation of the diffusion zone is $1.6 \cdot 10^{-2}$ mm/min, but after a few days it is $0.7 \cdot 10^{-6}$ mm/min. The diffusion-zone propagation is not uniform, but proceeds in steps with periodical stops whose duration gradually increases with the time; this is apparently caused by a gradual decrease in the supply of gallium. The application of additional gallium accelerates the propagation of the diffusion zone, but with a

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considerable delay after the application. The rate of diffusion-zone propagation differs, depending on direction, owing apparently to a different grain orientation. The grain size in the diffusion zone is small, approximately 50 μ compared to the initial 500 μ grain size of tin, which proves that gallium has a grain refining effect. The author expresses his thanks to T. M. Aver'yanova, L. L. Krapivin, Ye. D. Shchukin, B. D. Summ, A. V. Pertsov and M. V. Pertsov for their assistance. Orig. art. has: 7 figures.

SUB CODE: 11/ SUBM DATE: 008/ ATD PRESS: 5102

3424 MIRKIN L. A.

Uprochneniye detaley mashin yelektroiskrovym sposobom. M., 1954. 24 s s ill. 20 sm (M-vo transp. mashinostroeniya SSSR. Vsesoyuz. Proektno-tekhnol. in-t VPII. Obem tekhn opygom vyp. 122) 1.000 ekz V. Ts Avt UKAZAN NA 3 y s (54-44062ZH) 621.80-28+621 719): 537.32

MIRKIN, L.A.

USSR/ Engineering - Machining

Card 1/1 Pub. 128 - 11/25

Authors : Mirkin, L. A., Cand. Techn. Sc.

Title : Hardening of machine parts by the electro-spark method

Periodical : Vest. mash. 35/4, 48-51, Apr 1955

Abstract : The results of laboratory experiments, carried out by the Kirov Metallurgical Plant for the purpose of finding a rational method of hardening of machine parts, are briefly described. It was found that the electro-spark hardening method warrants a considerable strengthening (hardening) of the surface layer and increases the wear resistance of many machine parts. It is stated that electro-spark hardening possesses all the necessary qualities for broad introduction into industry. The process is considered simple it requires no capital equipment and the electrode and electric power consumption is considerably low. Table; graphs; drawing.

Institution : .....

Submitted : .....

DENIKAYEV, R.Z.; KOLOMEYETS, Ye.V.; KOZAK, L.V.; MIRKIN, L.A.

Using a neutron detector. Geomag. i aer. 2 no.5:1010-1011 S-O '62. (MIRA 15:10)

1. Kazakhskiy gosudarstvennyy universitet.
(Cosmic rays) (Neutrons--Measurement)

KOZAK, L.V.; KOLOMEYETS, Ye.V.; MIRKIN, L.A.; PRILEPSKIY, B.A.; ROSHCHUPKIN, V.I.

Azimuthal μ-meson telescope of the cosmic ray station of Kazakh State University. Geomag.i aer. 2 no.6:1148-1150 N-D '62. (MIRA 16:1)

1. Kazakhskiy gosudarstvennyy universitet.
(Alma-Ata--Telescope) (Cosmic rays)

S/122/62/000/012/002/007
D262/D308

AUTHOR: Mirkin, L.A., Candidate of Technical Sciences

TITLE: Glue joining of parts made of different metals

PERIODICAL: Vestnik mashinostroyeniya, no. 12, 1962, 29-32

TEXT: The glue, used for experiments described in this article, consisted of 57 % epoxide resin, 12 % maleic anhydride and 31 % Portland cement. Glue joints of steel and bronze bushes, alloy and steel blank flanges, and steel pins in aluminum alloy housings were tested at various pressures and temperatures. Conclusions: for tight fitting of parts made of different metals, glues with an epoxide resin base can be used. For temperatures not exceeding 80°C, glue joints between smooth surfaces with diametrical clearances up to 0.15 mm. Sudden changes in temperature (0 - 80°C) do not impair the quality of the joints. To obtain tight fits, the width of the glued surfaces should not be less than 5 - 6 mm. For joints working under pressure up to

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Glue joining of parts made of ... S/122/62/000/012/002/007
D262/D308

15 kg/cm^2 and at temperatures up to 1200C one or two fitting straps with 5 - 6 mm wide crosspieces between them should be used. There are 2 tables and 5 figures.

Card 2/2

L 4514-66 EWT(1)/EWT(m)/FCC/EWA(h) GS/GW

ACCESSION NR: AT5022841 UR/0000/65/000/000/0280/0282

AUTHOR: Denikayev, R. Z.; Kolomeyets, Ye. V.; Kozak, L. V.; Mirkin, I. A.; Prilepskiy, B. A.; Roshchupkin, V. G.

TITLE: Test operation of the neutron monitor and Mu-meson telescope

SOURCE: Vsesoyuznoye soveshchaniye po kosmofizicheskomu napravleniyu issledovaniy kosmicheskikh luchey. 1st, Yakutsk, 1962. Kosmicheskiye luchi i problemy kosmofiziki (Cosmic rays and problems in cosmophysics); trudy soveshchaniya. Novosibirsk, Redizdat Sib. otd. AN SSSR, 1965, 280-282

TOPIC TAGS: cosmic ray measurement, neutron counter, mu meson, cosmic ray telescope, particle counter, error correction

ABSTRACT: The present authors list 10 changes introduced in the neutron monitor of the cosmic ray station of the Kazakh State University, which started operation in 1957 encountered current leakages, various instabilities, and errors in design. The changes listed contributed to an improved operation of the monitor during the last four years. A brief description is given of the design and operation of an azimuthal 4π-meson telescope intended for continuous registration of the directed intensity of hard cosmic ray components. The device, which was put in operation in 1962, consists of four identical counter sections each

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L 4514-66

ACCESSION NR: AT5022841

pair of which registers particles coming from a given zenith angle but from opposite azimuthal directions. "The authors thank senior engineer Yu. Kapitonov for advice and help during the investigation." Orig. art. has: 3 figures.

ASSOCIATION: None

SUBMITTED: 29Oct64

ENCL: 00 SUB CODE: AA, NP

NO REF SOV: 003

OTHER: 000

PC

Card 2/2

137-58-4-8525

Translation from Referativnyy zhurnal, Metallurgiya 1958 Nr 4 p 315 (USSR)

AUTHORS. Kachanov, N.N., Mirkin L.I.

TITLE X-ray Tubes for High-speed and Super-speed Photography and X-ray Research Procedures (Rentgenovskiye trubki dlya skorostnoy i sverkhskorostnoy s"yemki rentgenogramm v praktike rentgenostrukturnykh issledovaniy)

PERIODICAL Tekhnol. avtomobilestroyeniya 1957 Nr 5, pp 72-76

ABSTRACT A survey. A brief description is presented of the design of Soviet and foreign sharp-focus tubes with punctuate and linear focus. The modes of operation of various parts for tubes with controllable focus, with magnetic focusing, with rotating plates etc., are presented. It is noted that the use of sharp focusing tubes permits exposure to be reduced by 98-98.4%. Or pulse operation from batteries exposure is reduced to 0.03-0.05 sec this makes it possible to investigate fast-moving processes (structural changes in heating, impact stresses etc.).
Bibliography 15 references

Card 1/1 1. X-ray tubes--Design X-ray ... V. Sh
3. X-ray analysis--[illegible]

137-58-4-8519

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 4, p 313 (USSR)

AUTHORS: Kachanov, N.N., Mirkin, L.I.

TITLE: An Ionization Method of X-ray Structural Analysis of Metals (Ionizatsionnyy metod dlya rentgenostrukturnogo analiza metallov)

PERIODICAL: Tekhnol. avtomobilestroyeniya, 1957, Nr 5, pp 76-79

ABSTRACT: An ionization method of recording X-ray radiation is described and comparison thereof with the photographic method is made. This method requires ionizing X-ray apparatus with an automatic recording arrangement. Ionizing X-ray apparatus have come into use in the investigation and inspection of materials used in the construction of machinery, phase analysis of metals and alloys, and also in the determination of residual stresses in metals. In studying the structure of the material the level of accuracy is higher than by the photographic method with a very pronounced reduction in the total time required for an investigation. This makes it possible to study transformations in alloys directly during the process of heat treatment or in the process of elastic and plastic deformation.

Card 1/1 1. Metals--X-ray analysis 2. Metals--Phase studies 3. X-ray --Ionizing effects

MIRKIN, L.I., inzh.; KACHANOV, N.N., kand.tekhn.nauk; UMANSKIY, Ya.S., doktor tekhn.nauk, prof.

Effect of high temperature heat treatment on the fine crystalline structure of steel. Izv. vys. ucheb. zav.; chern.met. no.7:153-156 Jl '58. (MIRA 11:10)

1. Moskovskiy institut stali.
(Steel--Heat treatment) (Metallography)

MIRKIN, L.I.

Method of ionization registration in applied X-ray structure analysis. Zav. lab. 24 no.5:569-576 '58. (MIRA 11:6)
(Ionization chambers) (X rays--Industrial applications)

18(3), 18(7)

AUTHORS: Mirkin, L. I., Umanskiy, Ya. S.

SOV/163-59-1-39/50

TITLE: Interlinkage of the Elements of the Fine Structure of Metals and Alloy Crystals During Consolidation by Means of Hardening and Plastic Deformation (Vzaimnaya svyaz' elementov tonkoy kristallicheskoy struktury metallov i splavov pri uprochnenii putem zakalki i plasticheskoy deformatsii)

PERIODICAL: Nauchnyye doklady vysshey shkoly. Metallurgiya, 1959, Nr 1, pp 179-181 (USSR)

ABSTRACT: This paper gives an account of the X ray investigation of a plastically deformed ferritic steel (with 1.5 and 3% Mn) of the hardened steels 20, 18KhGT, 30KhGT and of low carbon Armco-type steel. The study was intended to provide information on the interlinkage of the fine structure elements. The diagrams obtained demonstrate that the increase in the distortions of second order to not correspond to a reduction but to an increase in grain size. The same results were obtained in an investigation of iron-vanadium alloys. This phenomenon is explained as follows: The thermal stresses and the stresses originating during phase transformations place the metal into a state approaching that of

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Interlinkage of the Elements of the Fine Structure of Metal- and Alloy Crystals During Consolidation by Means of Hardening and Plastic Deformation

maximum deformation. This means that every grain is exposed to the maximum strain which it is capable of sustaining. Similar processes also occur with large plastic deformation. The experiments showed that the differences discovered in the investigation of the fine structure of crystals of steel subjected to different consolidation processes are connected with the fact that in a hardened or deformed alloy the crystal lattice is not in an equilibrium state which it but approaches after drawing. There are 3 figures and 2 Soviet references.

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED: February 22, 1958

Card 2/2

MIRKIN, L.I., inzh.

Strengthening and softening of manganese-alloyed ferrates.
Izv.vys.uchab.zav.; chern.met. 2 no.6:63-66 Je '59.
(MIRA 13:1)

1. Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti. Rekomendovano kafedroy rentgenografii i fiziki metallov Moskovskogo instituta stali.
(Manganese alloys--Metallography)

MIRKIN, L.I., aspirant

X-ray investigation of the surface layer of tempered 45 steel after grinding. Izv.vys.ucheb.zav.; mashinostr. no.6: 158-161 '59. (MIRA 13:5)

1. Moskovskiy institut stali.
(Steel--Testing) (X rays--Industrial applications)

AUTHOR: Mirkin, L.I. SOV/126-7-4-19/26

TITLE: On Relative Strain Hardening of Metallic Alloys in Plastic Deformation

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 4, pp 628-629 (USSR)

ABSTRACT: The object of the investigation described in the present paper was to study the effect of small (1 to 3%) additions of manganese and vanadium on the response of Armco iron to strain hardening by cold rolling. The experimental materials, constituting single-phase alloys, were examined both after having been plastically deformed by cold rolling to 80% reduction in thickness and in the fully annealed condition. The degree of strain hardening was determined by hardness measurements and X-ray analysis (the width and intensity of the (110) and (220) lines). It was found that addition of vanadium increases hardness of ferrite both in the annealed and deformed condition, which is typical for ferrite containing alloying conditions (Ref 1 and 2). Addition of vanadium does not increase, significantly, hardness of the alloys in annealed condition, while hardness of the alloys containing

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On Relative Strain Hardening of Metallic Alloys in Plastic Deformation

vanadium and deformed to 80% reduction, is considerably lower than that of deformed iron (185 against 218 Vickers hardness number). The response of the studied alloys to strain hardening was characterised by the relative degree of strain hardening, A, calculated from the formula

$$A = \frac{Hv_{def} \pm Hv_{ann}}{Hv_{ann}}$$

where Hv_{def} and Hv_{ann} are the Vickers hardness numbers of the alloys in the deformed and fully annealed condition respectively. The relationship between the content of the alloying addition (%) and the value of A is shown in Fig 1. It will be seen that pure iron is characterized by highest relative degree of strain hardening (1.30) and that the value of A rapidly decreases as the content of vanadium, and particularly manganese, increases. These results are in good qualitative agreement with those obtained from calculations in which data obtained by other workers, who had studied the absolute values of strain hardening of ferrite, were used. Thus, the relationship between

On Relative Strain Hardening of Metallic Alloys in Plastic Deformation

the content of alloying additions of the value of A, based on results obtained by Austin (Ref 1) and Shteinberg (Ref 2), is shown in Fig 2 (a - graphs based on data from Ref 2; b - graphs based on data from Ref 1). It will be seen that even in the case of alloying additions which have a considerable hardening effect, the relative degree of strain hardening decreases with increasing content of the alloying additions (Ni, Mn, Cr, Mo, V, Co, Nb, Si). Calculations based on data obtained by Dean (Ref 3), show that similar relationship can be obtained if the relative degree of strain hardening is determined by comparison of five other mechanical properties of the studied alloys in the deformed and annealed condition, while calculations based on data obtained by Shmid (Ref 4) show that the Cd-Zn, Al-Mg and Zn-Mg alloys are subject to the same effect. In order to explain the nature of this effect, the magnitude of static distortions of the third order in the crystal lattice of various alloys, was studied. It was shown that the formation of static distortions of the

On Relative Strain Hardening of Metallic Alloys in Plastic Deformation

crystal lattice is one of the main factors determining the degree of strain hardening of iron (Ref 5). Similar results for alloyed ferrite were obtained in the cause of the present investigation; annealed, pure iron which is practically stress-free, was used as the standard. The experimental results obtained for the Fe-Mn alloys are reproduced in Fig 3, where static distortions of the third order ($\sqrt{u-2}$, Å) are plotted against the manganese content (%). It will be seen that increasing the manganese content of annealed iron to 3%, resulted in a considerable increase of the distortions from 0 to 0.16Å. Plastic deformation of pure iron increases static distortions from 0 to 0.15Å; the distortions of the alloy containing 1.5% are increased after plastic deformation from 0.07 to 0.17Å, i.e. by 0.10Å, in the alloy containing 3% manganese, the corresponding increase caused by deformation is from 0.16 to 0.19Å, i.e. by 0.03Å. It can be seen in Fig 3 that although with the increasing manganese content in ferrite the static distortions in deformed material increase, the increase of distortions

On Relative Strain Hardening of Metallic Alloys in Plastic Deformation

in plastic deformation becomes smaller at higher concentrations of manganese. Examination of the experimental results obtained by Golubkov (Ref 6) shows that the increase of distortions due to deformation in pure iron, amounts to 0.10Å while deformation of alloys containing Ni, Mn, Mo, Ti, V and W results in an increase of the distortions of the third order not exceeding 0.06Å. In the presence of such effective hardeners as tungsten the increase of distortions due to deformation is only 0.007Å. The results of the present investigation indicate that the residual distortions of the crystal lattice in annealed materials caused by the presence of alloying additions and increasing the hardness of the alloy, retard further distortion of the lattice during plastic deformation. As a result, increasing the concentration of the atoms of the alloying element in a solid solution gives about decrease of the relative strain hardening which is

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On Relative Strain Hardening of Metallic Alloys in Plastic Deformation SOV/126-7-4-19/26

proportional to the alloying element content. There are 3 figures and 6 references, 4 of which are Soviet and 2 English.

SUBMITTED: April 25, 1956

Card 6/6

AUTHOR: Mirkin, L.I. SOV/126-7-4-20/26

TITLE: On the Residual Broadening of Lines on X-Ray Diffraction Patterns of Annealed Steels

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 4, pp 630-631 (USSR)

ABSTRACT: The results of many investigations of the crystal structure of metals and alloys, subjected to various mechanical and thermal treatments, showed that the size of blocks and the magnitude of micro-stresses (distortions of the second order) in metals can change substantially during treatment (Ref 1). The author of the present paper investigated the variation of the line width on X-ray diffraction patterns of annealed carbon steels alloyed with chromium, manganese, boron, tantalum and tungsten. The specimens were subjected to various annealing treatments, including one in which the specimens were cooled slowly (in 10 hours) through the 1100 to 500°C range, so as to ensure uniform distribution of carbon and the alloying element in the solid solution. Fe-radiation was used in the X-ray work and the refracted beams were recorded by means of an ionization chamber.

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On the Residual Broadening of Lines on X-Ray Diffraction Patterns of Annealed Steels

The results showed that the line width of annealed steels is considerably larger than that of annealed Armco iron. The results of X-ray analysis of Armco iron and some of the steels are tabulated on p 630, where the chemical analysis of the steels and the width of the (110) and (220) lines (10^3 radians) are given. Fig 1 shows how the width of lines (110) and (220) (curves 1 and 2 respectively), varies with increasing carbon content of annealed steels, while the relationship between the integral intensity of lines (110) of annealed carbon steels and their carbon content is illustrated in Fig 2. If it is acceded that, as usually happens in annealed materials, the integral intensity of lines (110) is affected by extinction, then the form of the curve in Fig 2 indicates that the size of the blocks in annealed steels decreases with increasing carbon content. Calculations carried out by the method developed by Kurdyumov and Lysak (Ref 2) show that the residual broadening of lines is associated with the mosaic structure of the steel and that no

On the Residual Broadening of Lines on X-Ray Diffraction Patterns of Annealed Steels

micro-stresses are present in the annealed material. If a specimen of annealed Armco iron in which the block size is larger than 25×10^{-6} cm is chosen as a standard then the calculated block size for steels Ct 20 and Ct 45 are 8.3×10^{-6} and 4.6×10^{-6} cm, respectively. Thus, the results of the measurements of the width and integral intensity of lines on the X-ray diffraction patterns indicate that the size of the blocks in annealed steels decreases with increasing content of carbon and alloying elements. (Evidently, the duration of the annealing treatment and the rate of cooling of the annealed specimens was such as to ensure the attainment of stable crystal structure.) It follows, also, from the experimental data, that when the dimensions of blocks and distortions of the second order are determined for a series of alloys from the increase of the line width, it is possible to compare the absolute values of the obtained results, disregarding whether pure metal or an annealed alloy is chosen as a standard material. The results of

On the Residual Broadening of Lines on X-Ray Diffraction Patterns of Annealed Steels

the present investigation show that the mosaic structure of alloys is associated not only with the mechanical and thermal treatment they have received but also with certain other characteristics such as the composition of the solid solution, grain size etc, which seems to indicate that there is a certain maximum size of the blocks in the mosaic structure, characteristic for a given material. There are 2 figures, 1 table and 2 Soviet references.

SUBMITTED: July 28, 1958

Card 4/4

MIRKIN, L I

PHASE I BOOK EXPLOITATION SOV/3987

Kachanov, Nikolay Nikolayevich, and Lev Iosifovich Mirkin

Rentgenostrukturnyy analiz /polikristallov/; prakticheskoye rukovodstvo. (X-Ray Analysis /of Polycrystals/; Handbook) Moscow, Mashgiz, 1960. 215 p. Errata slip inserted. 5,000 copies printed.

Reviewer: V.G. Kostogonov, Engineer; Ed.: V.S. Lyuttsau, Candidate of Technical Sciences; Ed. of Publishing House: V.V. Rzhavinskiy, Engineer; Tech. Ed.: A.F. Uvarova; Managing Ed. for Literature on Metal Working and Instrument Making (Mashgiz): V.V. Rzhavinskiy.

PURPOSE: This book is intended for personnel in various types of metallurgical plant laboratories, and may be useful to persons in scientific research institutes and specialists in related fields.

COVERAGE: This handbook contains practical information on procedure in taking, processing and interpreting roentgenograms and on the application of x-ray analysis to various problems in metallurgy. Data on preparing specimens and selecting the type of camera for taking roentgenograms are given. Methods of

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X-Ray Analysis /of Polycrystals/; Handbook

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phase analysis of machine-building materials, and methods of study and quality control of materials during thermal, chemical-thermal and mechanical treatment processes are explained in detail. Methods of investigating internal stresses in materials and machine parts, and ways of measuring the dimensions of crystals are discussed. A number of practical examples are given for facilitating x-ray analysis. A considerable part of the methods of analysis discussed in the book have been developed in recent years. Some 400 Soviet and non-Soviet monographs and articles on x-ray structural analysis were used in writing this book. No personalities are mentioned. There are 38 references: 25 Soviet, 10 English, 2 German and 1 French.

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MIRKIN, L.I.

Changes in the fine crystal structure of industrial iron in tempering and annealing. Izv.vys.ucheb.zav.;fiz. no.2:148-150 '60.
(MIRA 13:8)

1. Moskovskiy institut stali i Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti.
(Iron--Metallography)

18.7500

82340

S/139/60/000/03/037/045
E073/E335

AUTHORS: Mirkin, L.I. and Umanskiy, Ya.S.

TITLE: Investigation of the State of the Crystal Lattice and the Density of Dislocations in Austenite and Ferrite During Phase Transformations

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Fizika, 960, No 3, pp 212 - 217 (USSR)

ABSTRACT: The block dimensions and Type II distortions in the α-phase of carbon and alloy steels after various types of heat treatment were measured and the results were described in numerous papers by the School of G.B. Kurdyumov. However, only very few papers are devoted to the intragranular structure of the gamma-phase (Refs 1,2). The authors consider it of interest to investigate the intragranular structure of the α- and γ-phases in steels after various heat treatments. The experiments were carried out on steel 45 (0.4% C) and on austenitic manganese steel (0.4% C, 12% Mn), which were quenched from temperatures between 600 and 1 200 °C and tempered at temperatures of 200 - 700 °C with a

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Investigation of the State of the Crystal Lattice and the Density of Dislocations in Austenite and Ferrite During Phase Transformations

soaking time of 1 hour. The investigations were carried out using Fe radiation on URS-50I equipment. The authors proposed using the method of determination of the density of dislocations from the widening of the lines on the X-ray diffraction patterns for studying heat-treatment processes. Data are given on the change of the dislocation densities of the austenite and ferrite during quenching and tempering (Tables 1,2). On the basis of the obtained results, the authors propose the following mechanism for the dislocations during quenching and tempering: during quenching of steel a large number of point defects and dislocations occur in α-phase crystals during γ-α transformation and these are concentrated at block boundaries and distributed inside the block, i.e. distorting the lattice. The increase of the number and length of the dislocations inside the block corresponds to the increase of Type II distortions whilst an increase of the number of closing loops (relaxed defects) corresponds to an increase of the degree of dispersion

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S/139/60/000/03/037/045
E073/E335

Investigation of the State of the Crystal Lattice and the Density of Dislocations in Austenite and Ferrite During Phase Transformations

of the blocks. Thus, the density of dislocations characterises both elements of the fine crystalline structure, namely, the block dimensions and the Type II distortions. There are 3 figures, 2 tables and 9 references, 7 of which are Soviet and 2 English.

ASSOCIATION: NII tekhnologii avtomobil'noy promyshlennosti (Scientific Research Institute of Technology of the Automobile Industry)
Moskovskiy institut stali (Moscow Institute of Steel)

SUBMITTED: July 9, 1959

Card 3/3

S/139/60/000/005/016/031
E073/E135

AUTHOR: Mirkin, L.I.

TITLE: X-ray Diffraction Study of the Surface Layer of Polished Material by the Method of Taking Exposures at an Angle

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Fizika, 1960, No. 5, pp 96-99

TEXT: Investigation of the structure of surface layers of materials after various types of mechanical working (machining) have shown that almost all the structural changes are localised in a thin layer at the surface of the specimen. Earlier investigations (Ref 1) of the state of the crystal lattice in the surface layer of annealed and hardened steels were carried out by successive removal, by electrolytic etching, of layers and taking X-ray diffraction pictures of the surface. In applying this method it is usually possible to remove by etching layers of a thickness of 2 microns. The thickness of the layer that participates in forming the diffraction pattern can be approximately determined from the relation

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S/139/60/000/005/016/031
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X-ray Diffraction Study of the Surface Layer of Polished Material by the Method of Taking Exposures at an Angle

$$x = \frac{k}{\mu} \qquad (1)$$

where μ is the linear coefficient of absorption of X-rays in the material under investigation. k a coefficient depending on the fraction of the intensity of the reflected beam that is associated with the layer of a depth x in microns. For most materials and radiations the thickness of the layer that participates in forming the diffraction pattern considerably exceeds the thickness of the layer in which structural changes take place during grinding For investigating the changes in the state of crystal lattice in thinner surface layers it is of interest to take X-ray diffraction patterns at an angle, utilizing the principle that the size of the absorbing layer (data of which are given in Table 1) determines the path of the X rays in the material and not the depth of penetration of these rays; the depth of penetration will obviously depend on the angle of incidence. By means of this method the surface layers of carbon

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S/139/60/000/005/016/031
E073/E135

X-ray Diffraction Study of the Surface Layer of Polished Material by the Method of Taking Exposures at an Angle

steels after annealing and after grinding were investigated; the X-ray diffraction patterns were produced by means of iron radiation using УРС-50И (URS-50I) ionisation X-ray equipment. This enables measuring with great accuracy (up to 1') the rotation of the specimen and of the counter, and to carry out changes in the intensity and width of the lines with a greater accuracy than is possible by using a photographic method of recording (Refs 3, 4). Evaluation of the obtained results indicates that for ground surfaces, ground with a rate feed of 0.01 mm and a speed of table movement of 30 m/min, the density of defects in the surface layer increases up to a depth of about 4 microns, then begins to drop, reaching a constant value equalling that of annealed steel at a depth exceeding 11 microns. This indicates that during grinding of annealed steel 45 plastic deformation takes place in the layer to a considerable depth. Thereby the external layer softens due to heating during grinding. The described method can also be used for determining

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X-ray Diffraction Study of the Surface Layer of Polished Material by the Method of Taking Exposures at an Angle

the phase distribution in the surface layer, and particularly for determining the depth of the austenite layer which forms during grinding of quenched high carbon steels.

Acknowledgements are made to Doctor of Physical and Mathematical Sciences B.M. Rovinskiy for his useful advice.

There are 3 figures, 1 table and 6 references: 5 Soviet and English.

ASSOCIATION: NII tekhnologii avtomobil'noy promyshlennosti (Scientific Research Institute on Technology of the Motor Car Industry)

SUBMITTED: December 1, 1959

Card 4/4

AUTHOR: Mirkin, L.I.

S/126/60/009/03/024/033
E111/E452

TITLE: X-Ray Investigation of the Surface Layer in the Grinding of Low-Temperature Tempered Eutectoidal Steel

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 3, pp 459-460 (USSR)

ABSTRACT: In this letter to the Editor, the author refers to his previous work (Ref 1) which showed the existence of hardened and softened regions in the surface of type 45 steel (0.4% C). The surface layer during grinding of eutectoid steel in which a two-phase austenite-martensite structure had been produced through high temperatures in mechanical working is of related interest and has now been studied by the author. Type U-8 (0.8% C) steel hardened from 800°C, tempered for 1.5 hours at 180°C and ground; layers were removed electrolytically at 0.005 mm thick intervals. A type URS-501 X-ray installation, Fe-radiation and ionization registration were used for the investigation. Block dimensions, crystal-lattice distortions and dislocation density were determined. The latter is shown graphically as a

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S/126/60/009/03/024/033
E111/E452

X-Ray Investigation of the Surface Layer in the Grinding of Low-Temperature Tempered Eutectoidal Steel

function of layer depth for the alpha and gamma phases (curves 1 and 2 respectively). The author states that for a detailed analysis of the dislocation mechanism in the grinding of hardened high-carbon steel, further investigation and improved methods of calculation are needed. There are 1 figure and 5 references, 4 of which are Soviet and 1 English.

ASSOCIATION: Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti (Scientific Research Institute for Automobile-Production Technology)

SUBMITTED: June 22, 1959

Card 2/2

18.7500

80887
S/126/60/009/06/014/025
E073/E335

AUTHORS: Mirkin, L.I. and Umanskiy, Ya.S.

TITLE: Investigation of the State of the Crystal Lattice and of the Density of Dislocations in the Case of Phase Transformations in Steels

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 897 - 902 (USSR)

ABSTRACT: This paper was presented at the Sixth All-Union Conference on Using X-rays for Investigating Material, held in June, 1958.
The authors investigated the intracrystalline structure of steel 45, containing 0.4% C, and of austenitic manganese steel, containing 0.4% C and 12% Mn, after quenching from temperatures between 600 and 1 200 °C and tempering at temperatures of 200 - 700 °C. They consider the problem of selection of a standard in determining the dimensions of blocks and type II distortions in the material. The authors propose application of the method of determination of the density of dislocations from the widening of the lines on X-ray patterns for the purpose of investigating processes taking place during heat treatment. As a result

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S/126/60/009/06/014/025
E073/E335

Investigation of the State of the Crystal Lattice and of the Density of Dislocations in the Case of Phase Transformations in Steels

of the experiments, data were obtained on the changes in the density of dislocations in the austenite and in ferrite during quenching and tempering of the steels. The authors propose a probable dislocation mechanism of the processes taking place in α and γ phases during quenching and tempering of steels: during quenching of steel a large number of point defects and dislocations occur in the α phase during γ-α transformation, which are concentrated at the block boundaries and distributed inside the block, i.e. distorting the lattice; increase of the number and the extent of such dislocations inside the block will bring about an increase in "type II" distortions, whilst an increase in the number of closed chains (relaxed defects) will correspond to an increase of the degree of dispersion of the blocks. Thus, the density of the dislocations characterises both the block dimensions and the type II distortions. In the case of quenching of steels with a mixed $\gamma + \alpha$ structure, the

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E073/E335

Investigation of the State of the Crystal Lattice and of the Density of Dislocations in the Case of Phase Transformations in Steels

mechanism of these processes changes to some extent. There are 5 figures and 11 references, 9 of which are Soviet and 2 English.

ASSOCIATION: Moskovskiy institut stali im I.V. Stalina (Moscow Steel Institute imeni I.V. Stalin)

SUBMITTED: July 25, 1959

Card 3/3

MIRKIN, L.I.

X-ray investigation of the density of defects in crystal lattices during the hardening and tempering of low-carbon steel. Fiz. met. i metalloved. 10 no.2:312-313 Ag '60. (MIRA 13:9)

1. Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti.
(Steel--Heat treatment) (Metallography)

23621

S/148/60/000/012/010/020
A106/A133

1454, 1555, 1418

18 9200

AUTHOR: Mirkin, L. I.

TITLE: Changes in the density of defects of the crystal lattice during the hardening and tempering of low-carbon steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no. 12, 1960, 97 - 98

TEXT: The density of defects (dislocations) is a value which well characterizes the state of material, and it had been shown that the dislocation density is connected with the square of the extension of lines (Ref. 1: G. K. Williamson, R. Smallman. Phil. Mag., 1956, 1, 34). The dislocation density was evaluated by the line (110) extension on X-ray photographs. Specimens of low-alloy steel - 18XГТ (18KhGT) (0.2% C, 1% Cr; 1% Mn, 0.1% Ti) and 30ХГТ (30KhGT) (0.35% C; 1% Cr, 1% Mn; 0.2% Ti) were hardened at 920, 1,000, 1,100 and 1,200°C and tempered at 0 - 700°C with 1.5 hr holding. The УРС-50И (URS-50I) ionization X-ray camera yielded satisfactory photographs even of very blurred lines; FeK_{α}-radiation was used for the investigation. The dislocation density obtained by the formerly described method (Ref. 2:

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23621

S/148/60/000/012/010/020
A161/A133

Changes in the density of defects of the

L. I. Mirkin, Ya. S. Umanskiy. Nauchnyye trudy vysshey shkoly. Fizika, 1960, no. 2, 119) was only approximate, therefore only a relative comparison is possible. The measurement results are illustrated. In figure 4, for 18KhGT steel, the curves 1 and 2 are analogous, but the absolute dislocation density values after hardening at 1,000°C are higher than after hardening at 920°C and, to a high tempering temp. The density increases in the hardened state with an increase in the hardening temperature to 1,100°C (Fig. 4, curve 4), but a further rise in the hardening temperature to 1,200°C resulted in a lower density (curve 4). This corresponds to the results of experiments with austenite steel, with no phase transformations (Ref. 3). Consequently, the dislocation density in the alpha lattice considerably depends on the initial austenite state before hardening. The curves for 30KhGT steel are analogous. The curve has been plotted beginning with 200°C in tempering to eliminate the effect of the martensite tetragonality that is possible in quenching. The curves are essentially similar with the microstresses and block dimension curves determined previously for the same steel. There are 2 figures.

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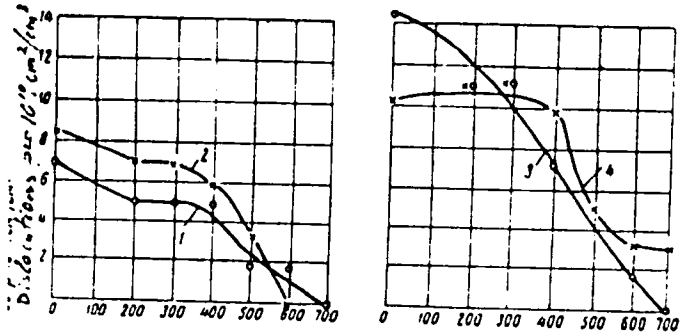
Changes in the density of defects of th ...

ASSOCIATION: Nauchno-issledovatel'skiy institut tekhnologii avto bil'noy promyshlennosti (Scientific Research Technological Institute of the Automobile Industry)

SUBMITTED: December 8, 1959

[Abstractor's note: Essentially complete translation]

Fig. a.



a.

Card 3/4

MIRKIN, L. I.

Cand Tech Sci - (diss) "X-ray study of defects of crystalline structure and toughening of several steels in hardening and annealling." Moscow, 1961. 22 pp; (Academy of Sciences USSR, Inst of Metallurgy imeni A. A. Baykov); 150 copies; price not given; list of author's works on pp 21-22 (10 entries); (KL, 7-61 sup, 241)

PHASE I BOOK EXPLOITATION SOV/5816

Mirkin, Lev Iosifovich

Spravochnik po rentgenostrukturnomu analizu polikristallov (Manual on the X-Ray Structural Analysis of Polycrystals) Moscow, Fizmatgiz, 1961. 863 p. Errata slip inserted. 9000 copies printed.

Ed. (Title page): Ya. S. Umanskiy, Professor; Eds.: G. A. Gol'der and Ye. F. Makarov; Tech. Eds.: N Ya. Murashova and N A. Tumarkina

PURPOSE: This handbook is intended for laboratory technicians at x-ray laboratories of scientific research institutes and factories. It may also be used by physicists, engineers, and students studying the structure of materials.

COVERAGE: The book contains data necessary in choosing methods for obtaining and calculating radiographs of polycrystalline bodies. There are tables and graphs for the solution of general as well as a number of special problems in

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the x-ray analysis of polycrystals. The present work, the author holds, is the first attempt to give a complete summary of data from the most important branches of the structural analysis of polycrystals. Material has been used from the numerous published results of Soviet and non-Soviet research up to 1959 and 1960; some graphs and tables are published here for the first time. The handbook contains a considerable number of numerical constants, supplementary material relative to the application of the various methods of x-ray analysis, instructions for carrying out the first steps in analysis necessary for the solution of most of the particular problems, and data required for the solution of concrete problems in x-ray analysis. The material is arranged in the order in which x-ray investigations are usually carried out. The following institutions are mentioned for their help: Moskovskiy universitet (Moscow University), Moskovskiy institut stali (Moscow Institute of Steel), Institut kristallografii (Institute of Crystallography), Tsentral'nyy nauchno-issledovatel'skiy institut chernoy metallurgii (Central Scientific Research Institute of Nonferrous Metallurgy), Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti (Scientific Research Institute of the

Automobile Industry), Fiziko-khimicheskiy institut im. Karpova (Physicochemical Institute imeni Karpov), Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov (All-Union Scientific Research Institute of Hard Alloys). The author thanks Professor Ya. S. Umanskiy, Professor V. I. Iveronova, Professor A. I. Kitaygorodskiy, G. A. Gol'der, and V. I. Rydnik. There are 463 references, mostly Soviet, English, and a few German.

TABLE OF CONTENTS:

MIRKIN, L.I.

Changes in the density of crystal lattice effects during the hardening and tempering of commercial iron. Izv. vys. ucheb. zav.; chern. met. no. 1:158-159 '61. (MIRA 14:2)

1. Moskovskiy institut stali.
(Iron--Heat treatment) (Crystal lattices)

S/148/61/000/011/013/018
E111/E480

AUTHOR: Mirkin, L.I.

TITLE: X-ray investigation of the high-temperature heat treatment of low-carbon steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.11, 1961, 152-154

TEXT: Heat treatment of steel at higher than usual temperatures is increasing. In the present work, changes in the fine crystal structure of type 20 carbon steel (0.2% C) on quenching and tempering were observed 20 x 10 x 10 mm specimens were quenched from 920, 1000, 1100 and 1200°C and tempered at 200 to 700°C, holding times being 1 and 1.5 hours respectively. Calculations were not made for the hardened state because of the difficulty of allowing for tetragonal martensite. X-ray patterns were obtained on a type УРС-50И (URS-50I) ionization installation with iron radiation. Block size and micro-strains were determined from broadening of (110) and (220) lines by the method of G.V.Kurdyumov and L.I.Lysak (Zhurnal tekhnicheskoy fiziki, v 17, 1947, 995) and N.N.Kachanov and L.I.Mirkin (X-ray analysis of the structure of polycrystals, Mashgiz, 1960) and dislocation density

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S/148/61/000/011/013/018
E111/E480

X-ray investigation of ...

from that of (110) lines Results were compared with hardness changes during tempering. The author concludes that his work confirms the view that the dislocation density in the alpha-iron after quenching is linked with that in the original austenite This conclusion is confirmed particularly by the fact that in purely austenitic steel, where no phase changes occur on quenching the change of dislocation density with hardening temperature follows the same law as in carbon steel. Very high dislocation density can be obtained by the quenching of austenite deformed at high temperatures without decomposition or recrystallization this increases strength. The author points out that further work is needed to obtain a quantitative relation between dislocation density in austenite and alpha-phase on hardening steels There are 2 figures and 6 references. 5 Soviet-bloc and 1 non-Soviet-bloc The reference to an English language publication reads as follows Ref 3: G K Williamson, R.Smallman Phil. Mag., 1, 34, 1956

ASSOCIATION: Moskovskiy institut stali (Moscow Steel Institute)

SUBMITTED May 3 1961

Card 2/2

21226

MIB, 1555, 1045

S/126/61/011/003/014/017
E073/E335

18 7600

AUTHOR: Mirkin, I.L.

TITLE: X-ray Investigation of the Processes Taking Place in Producing Superstrong Steel by the Method of Deformation Combined with Hardening

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol. 11, No. 3, pp. 472 - 473

TEXT: Schmatz and Zackay (Trans. ASM, 1959, 51 - Ref. 1) and Lips and van Znilen (Metal Progr., 1954, 66, 103 - Ref. 2) proposed a new method of increasing the strength of steels for which the isothermal transformation diagram has an intermediate range of stability of the austenite. By deforming supercooled austenite with subsequent hardening and tempering it is possible to obtain a steel of a strength of 350 kg/mm^2 with an elongation of 6-8% and sometimes even more. The author considered it of interest to investigate the changes in the structure of this steel that accompany the effect of hardening during this treatment. Steel 4Kh2 - (3Kh2V8) (0.3% C, 2% Cr, 8% W) was investigated for which the intermediate range

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S/126/61/011/003/014/017
E073/E335

X-ray investigation ....

of austenite stability is 475 - 600 °C. Specimens 20 x 10 x 10 mm were heated to 1 050 °C, cooled in air to 500 - 600 °C and then transferred to a press, the contact surfaces of which were also heated to the same temperature; in this the specimens were subjected to a 60% deformation, followed by quenching in water and tempering at 250-700 °C, the specimens were held for some time at these temperatures. Hardness measurements showed a hardness of 890 units, corresponding to a strength of 240 kg/mm^2. For tempering temperatures up to 500 °C the hardness changes only little, whilst the hardness of the same steel after quenching from 1 050 °C and tempering does not exceed 500 units ($\sigma_b \approx 180$ kg/mm^2). X-ray investigations were by measuring the widening of the (110) and (220) lines, using Fe$_K$ radiation; the block dimensions and microstresses were calculated and the density of the defects of the crystal lattice was estimated. After quenching and tempering at

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λ-ray Investigation ...

250 °C, the density of defects of the crystal lattice was very great, 47×10^{10} cm^2/cm^3 as compared with 20×10^{10} cm^2/cm^3 for quenched steel tempered at the same temperature. Fig. 1 shows the change in the density of crystal-lattice defects ζ as a function of the tempering temperature; Curve 1 pertains to deformation combined with hardening; Curve 2 refers to ordinary hardening. It can be seen that Curve 1 lies above Curve 2 for all tempering temperatures right up to 525 °C (Abstractor's note: "626 °C" according to Fig. 1) The density of the defects in the steel subjected to deformation with quenching followed by tempering at 700 °C is lower than it is for specimens with ordinary quenching. This phenomenon was also observed for the block dimensions. These are small for all tempering temperatures up to 525 °C and in specimens subjected to combined deformation and quenching it is very small (about 1.5×10^{-6} cm) and considerably smaller than in quenched and tempered steel. However, at 700 °C a reverse relation applies. Fig. 2 shows the block dimension, $D \cdot 10^{-6}$ cm, as a function of the

X-ray Investigation

tempering temperature. Here again Curve 1 applies to the specimens subjected to combined deformation and quenching, whilst Curve 2 applies to specimens subjected to ordinary quenching. It is pointed out that the hardness of the high-tempered steel after deformation followed by quenching (325 units) is small compared with the hardness of quenched and tempered steel (400 units). The magnitude of the micro-stresses in steel after deformation and quenching is very small at all tempering temperatures, which confirms the earlier conclusions of the author (Ref. 6) that low block dimensions in hardened materials correspond to lower micro-stresses and also the conclusions of Kardonskiy, Kurdyumov and Perkas (Ref. 7) relating to the absence of a decisive role of microstresses in the hardening of metals. The results of investigations lead to the assumption that during deformation of austenite in the temperature range 500-600 °C an intensive breaking up of the austenite blocks occurs and the formation of a large number of lattice defects. Due to the high recrystallisation temperature of the investigated

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X-ray investigation . . .

steel and the short holding time between deformation and quenching, these structural changes are not eliminated and on these a further breaking-up of blocks and an increase in the defect intensity takes place during quenching. Metallographic investigations of the author and electron microscope investigations of other authors have shown that as a result of this treatment the martensite has a very fine grain structure, the blocks are very small and the density of the lattice defects is extremely large and this brings about the high strength of the steel. It is pointed out that the achieved strength is not the limit and can be increased by appropriate selection of the conditions of treatment. After such a treatment, recrystallisation at elevated temperatures is more intensive and this is in agreement with the recrystallisation theory. Detailed results of X-ray and metallographic investigations and mechanical tests during various heat-treatment conditions will be published later. (Abstractor s note: this is a complete translation).

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X-ray Investigation ....

There are _ figures and 7 references: 4 Soviet and 3 non-Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut tekhnologii avtomobil'noy promyshlennosti (Scientific Research Institute on Technology in the Automobile Industry)

SUBMITTED: September 16, 1960

Card 6/6

S/129/62/000/001/002/...
E...

AU: Mirkin ...

TITLE: Investigation of ... is obtained by ... treatment and ...

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metal... no. 1, 62-...

TEXT: The ... in the present paper was ... the part played by dislocations in the structural changes which occur in steel during TMO (plastic deformation at ... followed by conventional hardening and tempering treatment; abbreviation of the Soviet 'termomekhanicheskaya obrabotka'). Experimental work was carried out on steels ... (3Kh2V3) (0.3% C, 3% Cr, 8% W, 0.80 to 0.9% C, 9% W, ... 2% V) and 3-13 (3Kh13) (0.3% C, 13% Cr). The specific characteristic of these steels is a wide temperature range (450 - 600 °C) in which the austenite is stable. Rectangular (20 x 10 x 10 mm) or cylindrical (10 mm diameter) test pieces were heated in a furnace to 1 050 - 1 150 °C, transferred to a forging press with plates pre-heated to 500 - 600 °C, compressed to 60 - 70% reduction and

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Investigation of high-strength...

where the hardness (HRC) is plotted against the tempering temperature (^{o}C) for specimens subjected to TMO (Curves 1) and a similar thermal treatment but without plastic deformation (Curves 2). The interesting feature of the results obtained was the fact that whereas the effect of tempering at temperatures lower than 500 ^{o}C was less pronounced in specimens subjected to TMO than in those subjected to other treatments, the decrease in hardness brought about by tempering at temperatures higher than 600 ^{o}C was greater in material subjected to TMO This indicated that although the energy threshold of recrystallization after TMO was higher, once this level had been reached the process of recrystallization in material subjected to TMO proceeded more intensively. The results of X-ray diffraction measurements showed that TMO brought about marked broadening of the X-ray lines. This is demonstrated in Fig. 4, where the width (B, 10^{-3} radians) of lines (110) of steel Kh2V8 is plotted against the tempering temperature (^{o}C) for specimens subjected to TMO (Curve 1), hardened by quenching from 1 050 ^{o}C (Curve 2), heat-treated as in TMO but without

Investigation of high-strength...

deformation (Curve 3) and cold-worked (Curve 4). Similar results were obtained for steels R9 and 3Kh13. Based on the results obtained, the following mechanism of the processes taking place during TMO was postulated. A certain number of dislocations exist in austenite at high temperatures. New dislocations are generated during plastic deformation and this brings about a decrease in the dimensions of blocks in austenite. The system departs from the equilibrium conditions and, if a sufficiently long time is allowed at a sufficiently high temperature (as, for instance, in hot-working operations), the effect of plastic deformation disappears. If, however, the time at temperature is short (as, for instance, during TMO carried out in the high-temperature range of stability of austenite), or if the rate of movement of dislocations is slow (as during TMO in the low-temperature range of stability of austenite), the number of dislocations in austenite at the beginning of the next stage of the treatment (quenching) is already relatively high. A large number of dislocations is generated in steel during quenching due to volume changes taking

place in martensite and, when quenching follows plastic deformation, the number of lattice defects in martensite is increased by dislocations present in the austenite at the beginning of this operation. It should be stated in this connection that the dislocation density in steel subjected to TMO is greater than the sum of the dislocation densities in two specimens, one of which has been hardened by conventional treatment and the other cold-worked. This means that each dislocation, present in the austenite at the beginning of the quenching operation, generates several dislocations in the resultant martensite.

There are 5 figures and 11 references: 6 Soviet-bloc and 5 non-Soviet-bloc. The four English-language references quoted are: Ref. 1: E.B. Kula, J.M. Dhosi - "TASM", v.52, 1960; Ref. 6: F.C. Frank - "Acta metallurgica", v.1, 1953; Ref. 7: J. Gilman, "Journal Appl. Phys", v.30, 1959; Ref. 9: G.K. Williamson, R. Smallman - "Philosophical magazine", v.1., 1956.

33460

S/129/62/000/001/002/011
E193/E383

Investigation of high-strength ...

ASSOCIATION: Nauchno-issledovatel'skiy institut mekhaniki MGU (Scientific Research Institute of Mechanics of MGU)

Fig. 2:

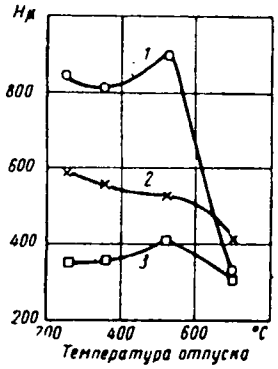


Fig. 3:

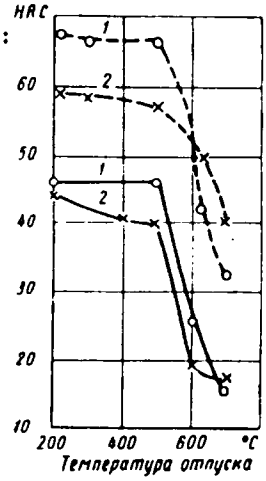
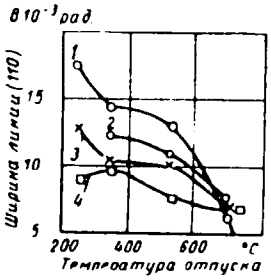


Fig. 4:



Card 6/6

18.7500

AUTHOR: Mirkin, L. I.

TITLE: [illegible]

PUB. DATA: [illegible]

TEXT: The dislocation density in [illegible] alloys was determined [illegible] method proposed by [illegible] and B. Warriman (Phys. Rev. [illegible] [illegible] based on the assumption that most of the dislocations [illegible] [illegible] of the block walls. Within the blocks, the [illegible] breaking-up of the lines in the X-ray pictures is essentially [illegible] square of the line broadening. The X-ray pictures were taken with a [illegible] (Cu-Kα) X-ray device with Fe radiation. Measurements were made of the [illegible] of the (211) line of the γ-phase (austenite) and of the (110) line of the α-phase (martensite). The steel specimens (0.[illegible] C, [illegible] Cr, [illegible] Mn, were heated to 1000°C, then rapidly cooled to 200-600°C, [illegible] and quenched in water. In case of phase transition each [illegible] austenite produces a few dislocations. The dislocation density [illegible]

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[illegible]
B[illegible]

Heredity of the dislocat[illegible]...

martensite is incre[illegible] when the hardening temperature [illegible] This is related to the improved [illegible] of the [illegible] At a hardenin[illegible] temperature of [illegible] the dislocation density [illegible] Its decrease at higher [illegible] temperatures is caused by the [illegible] recrystallization of austenite. Th[illegible] dislocation density in martensite [illegible] increased by prolonged exposure [illegible] re hardening. However, in [illegible] it is always greater than in austenite. There are [illegible] tables and [illegible] references: 2 Soviet and 1 non-Soviet.

ASSOCIATION: Nauchno-issledovatel'skiy institut mekhaniki Moskovsk[illegible] gosudarstvennogo universiteta im. M. V. Lomonosova (Scientific Research Institute of Mechanics of the Moscow State University imeni M. V. Lomonosov)

PRESENTED: July [illegible], [illegible], by [illegible] A. Rebinder, Academician

SUBMITTED: July 10, 1961

Card 2/2

S/148/63/000/001/012/019
E073/E451

AUTHOR: Mirkin, L.I.

TITLE: Structure of the surface layer during grinding of hardened eutectic steel

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Chernaya metallurgiya, no.1, 1963, 117-119

TEXT: The distribution of structural changes with depth after grinding was studied in the surface layer of hardened and low temperature tempered eutectic steel У8 (U8). Grinding conditions: transverse feed S_t 0.01 to 0.08 mm/min, longitudinal rate of travel S_{long} 15 to 30 m/min, number of passes 4 to 20. The abrasive wheel had a grain size of 46, hardness C_2, V_{long} = 30 m/min, vertical force 50 kg, cooling by an emulsion. The layer by layer analysis was by electrolytic removal of layers, every other 5 μ, the curve of the relationship between the block dimensions and layer depth in the α-phase shows nonuniformities with a maximum at 0.015 mm (S_t = 0.05 mm/min, S_{long} 15 and 30 m/min). The curves of the relationship between the microstresses and depth correspond fully to those for the block dimensions, in accordance with earlier published material.

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S/148/63/000/001/012/019
E073/E451

Structure of the surface ...

Changes in the feed rate showed a considerably greater influence on the structure of the surface layer than changes in the longitudinal rate of travel, similar results were obtained earlier in investigations on hardened Steel 45 after grinding. The grinding operation can be considered as the interaction of three basic processes: deformation of the surface layer, contact heating and rapid cooling. Deformation and cooling increase, and heating decreases the number of crystal lattice defects. The initial state of the crystal lattice of the hardened low-tempered steel is characterized by a higher concentration of the defects and, consequently, higher strength. Therefore, the distribution of the concentrations of defects through the depth of the layer differs greatly from that of annealed steel of the same composition after grinding, where the initial concentration of defects is small. Several possible distributions of the defect concentrations in the surface layer of hardened steel after grinding are discussed: the surface layer may become tempered, as in the case of grinding without cooling and even under some conditions of grinding with cooling; due to the high speed of

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cooling, the surface layer may become hardened and strengthened as a result of plastic deformation; the surface layer may soften due to high temperature and in this case the curve will have both a maximum and a minimum. Similar considerations apply to the block dimensions. The curves of the defect concentrations in the residual austenite and in the α-phase after grinding usually coincide. If the strengthening caused by plastic deformation and hardening or multiple hardening is taken into consideration, more complicated curves are obtained which may have several maxima with depth. There are 2 figures.

ASSOCIATION: Moskovskiy institut stali i splavov
(Moscow Steel and Alloy Institute)

SUBMITTED: March 20, 1961

Card 3/3

PERTSOV, A.V.; MIRKIN, L.I.; PERTSOV, N.V.; SHCHUKIN, Ye.D.

Spontaneous dispersion under conditions of a gain in free interphase energy. Dokl. AN SSSR 158 no.5:1166-1168 O '64.
(MIRA 17:10)

1. Moskovskiy gosudarstvennyy universitet im. M.V.Lomonosova. Predstavleno akademikom P.A.Rebinderom.

L 49451-65 EWP(z)/EWA(c)/EWT(m)/EWP(b)/T/EWA(d)/EWP(t) JD

ACCESSION NR: AP5010987 UR/0148/65/000/004/0156/0159

AUTHOR: Mirkin, L. I.

TITLE: Dislocation processes during tempering of carbon steels and problems of thermomechanical hardening

SOURCE: IVUZ. Chernaya metallurgiya, no. 4, 1965, 156-159

TOPIC TAGS: dislocation, steel hardening, x-ray diffraction pattern

ABSTRACT: X-ray structural analysis of the density of dislocations was made for two grades of steel. The technique used was a modification of that based on the broadening of (110) lines on x-ray diffraction diagrams. Quenching was from 920, 1100 and 1200°C and tempering was at 200°C. Plots of results show that the curve for the density of dislocations rises with the quenching temperature up to 1100°C after which it falls sharply. The dislocation density curve also coincides with the hardness curve. The effect of grain growth, solubility of impurities, work hardening, and recrystallization on dislocation density and movement is examined. Concerning the second aspect of this study, the hot working of steel, it is stated that deformation at a temperature above that of phase transformation sharply increases the dislocation density in austenite. As a result of the heriditary nature

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ACCESSION NR: AP5010987

of the dislocation structure, the density of dislocations after quenching likewise increases sharply, thereby improving the mechanical properties of the metal. With increased temperatures of deformation after the initial recrystallization of austenite, the effect of thermomechanical treatment is greatly reduced since dislocations at these temperatures move rapidly and recovery takes place rapidly, ending within the period between deformation and quenching. The practical significance of these processes with respect to hardness is discussed as is the possibility of increasing the temperature limit of hot working. Orig. art. has: 3 figures

ASSOCIATION: Nauchno-issledovatel'skiy institut mekhaniki Moskovskogo gosudarstvennogo universiteta (Scientific Research Institute of Mechanics, Moscow State University)

SUBMITTED: 20Jun64 ENCL: 00 SUB CODE: MM

NO REF SOV: 006 OTHER: 001

Card 2/2 CC

L 11264-66 FBD/EWT(1)/EWT(m)/EEC(k)-2/T/EWP(t)/EWP(k)/EWP(b)/EWA(m)-2/EWA(h)/EWA(c) 80
ACC NR: AP6002361 SCTB/IJP(c) JD/WG SOURCE CODE: UR/0207/65/000/006/0084/0086 79

AUTHOR: Aver'yanova, T. M. (Moscow); Mirkin, L. I. (Moscow); Pilipetskiy, N. F. (Moscow); Rustamov, A. P. (Moscow) 23

ORG: none

TITLE: The effect of intense light beams on the surface of a metal

SOURCE: Zhurnal prikladnoy mekhaniki i tekhnicheskoy fiziki, no. 6, 1965, 84-86

TOPIC TAGS: ruby laser, laser application, laser induced damage, metal damage, microhardness, armco iron, steel, lead, Duralumin, laser machining

ABSTRACT: The effects of high-intensity laser beams on metals (Armco iron, high- and low-carbon steels, lead, Duralumin) were investigated. The emission from the pulsed ruby laser shown in Fig. 1 was focused on the metal surface by means of a lens. The surface of the specimens was bombarded at right angles with 60—80 pulses per discharge, each pulse lasting 2—3 sec and delivering an energy of 1.4—1.6 j. The formation of beam-induced craters, 1.5 mm deep and ~1.5 mm in diameter, was observed. In the steels, three distinct regions around the craters were observed: a poorly-etched region with a fine-specular, martensitic structure directly abutting the crater, an adjacent region containing white, poorly etchable sections consisting of complex-shaped grains, and a third region, the outermost, exhibiting the original metal structure. The increased hardness (by 700 ± 500 kg/mm^2) observed in the

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ACC NR: AP6002361

crater region for low-carbon steels far exceeded that which results from thermal and mechanical methods of metalworking. The intensive hardening in low-carbon steels was associated with extremely short periods of energy liberation, although not all laser-induced effects can be considered as purely deformation effects. Increases in the hardness of the other metals was as follows: Armco iron, 80 kg/mm^2 (from

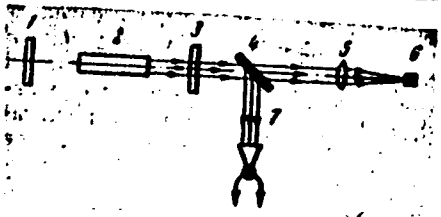

Fig. 1. Schematic of the ruby laser

1 - Mirror (reflection coefficient R = 99%); 2 - ruby crystal; 3 - mirror (reflection coefficient R = 30%); 4 - plane-parallel glass plate; 5 - lens; 6 - irradiated specimen; 7 - thermocouple calorimeter.

180 to 260 kg/mm^2); U-10 high-carbon steel (1% C), 600 kg/mm^2 (from 380 ± 140 to 1000 kg/mm^2); and high-speed steel, from 430 ± 50 to 650 ± 50 kg/mm^2. The depth of the crater in lead was considerably greater than in steel, and no changes in the structure and hardness in the crater region were observed. Duralumin showed certain softening in the crater region and was the only material to exhibit cracks in that region. The results confirm an earlier assumption (Mirkin, L. I., Fizika metallov i metallovedeniye, v. 7, no. 4, 1959, 628) that the relative hardening of metals due to thermal or mechanical working is lower the higher the strength of the original material attained by the introduction of doping elements. Orig. art. has: 6 figures.

[YK]

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L 11264-66

ACC NR: AP6002361

SUB CODE: 20 , 13 / SUBM DATE: 31Jul65/ ORIG REF: 002/ OTH REF: 001/

ATD PRESS: 4174

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BC

Card 3/3

GRYAZ[illegible] [illegible]

[illegible] investigation [illegible] the aging of low-carbon steel following peening. Izv.vys.ucheb.zav.; chern.met. 8 no.[illegible]:123-126 '65. (MIRA 18:8)

[illegible] Nau[illegible] institut mekhaniki Moskovskogo [illegible]vennogo universiteta.

L 54732-65 EWT(l)/EPA(s)-2/EWT(m)/EPF(n)-2/T/EWP(t)/EEC(b)-2/EWP(b)/EWA(c)
ACCESSION NR: AP5011752 Pt-7/Pi-4/Pu-4 IJP(c) UR/0126/65/019/004/0577/0582
JD/WW/JG/GG
548.535

AUTHOR: Mirkin, L. I.

TITLE: Formation of new crystals during interaction of tin with molten gallium

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 4, 1965, 577-582

TOPIC TAGS: gallium, tin, crystal growth, x-ray analysis, liquid metal

ABSTRACT: X-ray structural analysis is used for studying the spontaneous recrystallization of tin during interaction with molten gallium. It is found that recrystallization begins with the formation of crystals about 20μ in size in the initial large monocrystal. The number of these crystals increases very rapidly in the first stages of recrystallization. Several days after recrystallization begins, the number of crystals begins to diminish, asymptotically approaching some stable value. The new crystals which are formed during recrystallization are not stable and may apparently rotate, unite and dissolve during recrystallization. X-ray effects were noticed which indicate some nonuniformity in the solid solution or small microstresses during the first stage of recrystallization. The transition

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ACCESSION NR: AP5011752

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from the initial monocrystal to the new crystals is apparently due not to breaking up of the monocrystal into smaller units but to "dissolution" of the initial crystal which takes place in many cases deep within the crystal and not at the edges. "The author considers it his duty to thank L. L. Krapivin for considerable help in carrying out the experiments and also Ye. D. Shchukin, A. V. Pertsov and N. V. Pertsov for valuable advice during the work and discussion of the results." Orig. art. has: 6 figures.

ASSOCIATION: NII mekhaniki, Moskovskiy gosuniversitet im. M. V. Lomonosova (NII of Mechanics, Moscow State University)

SUBMITTED: 27Apr64 ENCL: 00 SUB CODE: SS, IE

NO REF SOV: 007 OTHER: 000

Card 2/

L 11426-66 EWT(m)/EPF(n)-2/T/EWP(t)/EWP(b) IJP(c) JD/WW/JG

ACC NR: AP6002112 SOURCE CODE: UR/0369/65/001/006/0659/0663

AUTHOR: Mirkin, L.I.

ORG: Moscow State University im. M.V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Diffractometric study of recrystallization of tin under the influence of liquid gallium

SOURCE: Fiziko-khimicheskaya mekhanika materialov, v. 1, no. 6, 1965, 659-663

TOPIC TAGS: tin, gallium, metal crystallization, x ray diffraction analysis, crystal orientation, nonferrous liquid metal

ABSTRACT: Changes in the absolute and relative line intensities of x-ray patterns of tin single crystals were studied on a URS-50I diffractometer after the deposition of liquid gallium and a contact of up to several days between the two metals. It was found that when gallium is deposited, several crystals with different orientations appear, and as time goes on, the following processes take place: crystals of similar orientations fuse together

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ACC NR: AP6002112

or acquire the same orientation, forming crystals with some intermediate orientation. At the same time, the opposite process consisting in the splitting and disorientation of crystals occurs. As time passes, the crystals split into a small number of orientations (about 10), and to each of the latter there correspond some relatively large crystals (or groups made up of a large number of fine crystals). Analysis of the azimuthal intensity distribution also shows that changes in structure during the gallizing are attenuated asymptotically with time. Additional energy (in the form of heating by 40 — 50C) intensifies the process of relative displacement of the crystals. Author thanks L. L. Krapivin for considerable assistance in the experimental work, and also Ye. D. Shchukin, A. V. Pertsov (who also grew the crystals), and N. V. Pertsov for valuable suggestions during the organization of the work and discussion of the results. Orig. art. has: 5 figures and 1 table.

SUB CODE: 11, 20 / SUBM DATE: 10Mar65 / ORIG REF: 008

Card 2/2

L 22707-66 EWT(m)/EPF(n)-2/T/EWP(t) IJP(c) JD/WW/JG

ACC NR: AP6009051 SOURCE CODE: UR/0207/66/000/001/0079/0082

AUTHOR: Aver'yanova, T. M. (Moscow); Mirkin, L. I. (Moscow); Pilipetskiy, N. F. (Moscow)

ORG: none

TITLE: Effect of light beam on the dislocation structure of crystals

SOURCE: Zhurnal prikladnoy mekhaniki i tekhnicheskoy fiziki, no. 1, 1966, 79-82

TOPIC TAGS: laser application, thermal optic effect, sodium chloride, crystal surface, surface hardening, crystal dislocation phenomenon

ABSTRACT: This is a sequel to earlier work by the authors (PMTF, 1965, no. 6), where it was shown that a laser beam incident on a metallic surface produces a crater, the hardness around which is several times higher than the hardness that can be obtained in the same material by any of the known mechanical or heat-treatment hardening methods. Since hardness is connected with the dislocation structure, the authors have investigated the changes produced by a laser beam in the dislocation structure of high-purity NaCl, on the surface of which the emergence of the dislocations can be readily displayed. Individual experiments were also carried out on single crystals of refractory tantalum metal. A ruby laser operating in the multiple-spike mode was used, in which stimulated emission was produced by a pump excitation at 3800—6100 Å from a flash lamp operated by

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L 22707-66

ACC NR: AP6009051

2

capacitor discharge. The laser and the apparatus used to measure its beam intensity are described. A microscopic investigation of the surface of the rock-salt crystals has shown that after multiple applications of the laser beam, cracks are produced on the surface, arranged in planes of the (100) type and directed along the [100] axis. Etching disclosed a large number of fresh dislocations of deformation origin. The changes in different regions of the surface are analyzed on the basis of the study of the dislocation structure. The results of the laser damage are compared with the results of other types of damage, such as cleavage, sudden cooling, and high-temperature deformation. It is concluded that the laser effect is similar to that produced by pulsed application of the same amount of heat as is released by the light beam. The authors thank G. I. Barenblat for a discussion of the results and R. V. Khokhlov for making the experiments with the laser possible. Orig. art. has: 8 figures.

SUB CODE: 20/ SUBM DATE: 10Sep65/ ORIG REF: 005/ ATD PRESS: 4229

[02]

Card 2/2 BK

L 22993-66 EWT(m)/EWP(w)/T/EWP(t) IJP(c) JD

ACC NR: AP6012238 SOURCE CODE: UR/0129/66/000/004/0070/0072

AUTHOR: Mirkin, L. I.; Filipetskiy, N. F.

ORG: Moscow State University. Scientific Research Institute of Mechanics (Moskovskiy Gosudarstvennyy Universitet. Nauchno-issledovatel'skiy institut mekhaniki)

TITLE: Hardening of steels under the effect of a laser beam

SOURCE: Metallovedeniye i termicheskaya obrabotka metallov, no. 4, 1966, 70-72

TOPIC TAGS: steel hardening, surface laser beam hardening, alloy hardening, steel property, alloy property

ABSTRACT: The effect of a laser beam on the structure and properties of carbon steels with 0.1—0.8% C in the initial and heat-treated conditions has been investigated. The laser beam formed a conical crater about 2 mm in diameter and 2 mm deep in all tested specimens. The metal of the zone adjoining the crater had a fine-grained structure and a microhardness of HV-1400; the next zone consisted of white, unetchable grains with a microhardness of HV-1500 and ferrite grains. The average hardness of the first and second zone was reduced to HV-950 and 890 after polishing the surface of specimens; it continues to

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L 22993-66
ACC NR: AP6012238

decrease with increasing depth from the crater surface. In specimens vacuum tempered at 600C, the hardness of the laser-treated zone exceeded the hardness of the parent structure. The carbon content in the crater zone increased under the effect of a laser beam. In hardened (and untempered) steel 45 with a martensitic structure, the laser produced a zone with a hardness HV-400 higher than that of the original martensite. An intensive surface hardening was also observed in high-carbon and alloy steels such as U8, R9, and 3Kh13. The hardness of VK8 alloy increased from HV-1200 to HV-2500. Orig. art. has: 4 figures. [AZ]

SUB CODE: 11, 14/ SUBM DATE: none/ ORIG REF: 007/ ATD PRESS: 4237

Card 2/2

ACC NR: AP6036840 SOURCE CODE: UR/0020/66/171/002/0324/0326

AUTHOR: Kozorezov, K. I.; Mirkin, L. I.

ORG: Scientific Research Institute of Mechanics, Moscow State University im. M. V. Lomonosov (Nauchno-issledovatel'skiy institut mekhaniki Moskovskogo gosudarstvennogo universiteta)

TITLE: Metal hardening under the effect of cumulative shock waves

SOURCE: AN SSSR. Doklady, v. 171, no. 2, 1966, 324-326

TOPIC TAGS: metal hardening, shock wave, shock wave metal hardening

ABSTRACT: The possibility of additional hardening of explosion-hardened metal by means of cumulative shock waves has been investigated. The cumulative shock waves were produced by shooting a low-carbon steel (St. 10) plate at a velocity of 3.69 mm/sec against a copper tube. Metallographic analysis showed that the basic structure of the plate consisted of approximately equiaxial grains about 50 μ in diameter, a typical structure for low-carbon steel and iron subjected to explosive deformation. Analysis of the crater caused by the impact revealed that there were several zones with quite different structures and hardness. The zone next to the crater surface consisted of large, equiaxial grains about 30 μ in size and had a hardness of 220 kg/mm^2, i.e., much higher than the initial hardness of ferritic grains in undeformed steel (170 kg/mm^2). The second zone consisted of fine equiaxial grains about 5 μ in size, and its hardness was 200 kg/mm^2. Around the side

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ACC NR: AP6036840

walls of the crater, there was a zone containing large grains whose hardness was 300 kg/mm^2. In the lower part of the crater not in contact with the tube during the test, a specific microstructure consisting of deformed grains with a large amount of twins was found. The hardness of this zone was 370 kg/mm^2. It is concluded that explosion-hardened low-carbon steel can be additionally hardened by cumulative shock waves. Orig. art. has: 3 figures.

SUB CODE: 11/ SUBM DATE: 20Sep65/ ORIG REF: 004/ OTH REF: 001/ ATD PRESS: 5108

Card 2/2

ACC NR: AP6032718 SOURCE CODE: UR/0374/66/000/004/0624/0625

AUTHOR: Mirkin, L. I.; Pilipetskiy, N. F.

ORG: Moscow State University im. M. V. Lomonosov (Moskovskiy gosudarstvennyy universitet)

TITLE: Main types of destruction of organic glass under the effect of pulsed laser beams

SOURCE: Mekhanika polimerov, no. 4, 1966, 624-625

TOPIC TAGS: organic glass, plexiglass, plexiglass destruction, laser beam, ~~pulsed laser beam~~, laser PULSATION, LASER EFFECT

ABSTRACT: A study has been made of the effect of pulsed laser beams on plexiglass. Plexiglass rectangular prisms and cylinders were irradiated with beams from a laser designed by the authors (ZhPMTF, 1965, 6) which produced beams with an energy of 5 j and a pulse duration of 10^{-3} to 10^{-8} sec. In the experiments the radiating power of the laser varied from 20 to 80 Mw and the focal length from 18 to 80 mm. Two types of plexiglass destruction were observed. On long-focus irradiation (10^{-8} sec), specimens were destroyed along the entire path of the beam, and small, almost spherical pores were formed in the material. The shape of the porous region was roughly that of the laser beam in the material. In this case, destruction is apparently due to the generation of heat on the microscopic inhomogeneities in the material. The heat causes chemical reactions which, in turn, cause the formation of

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ACC NR: AP6032718

pores. Long-focus irradiation produced in the material a kind of thermal explosion, whose center was located in the vicinity of the focus of the beam. Destruction of the material was strongly marked by flat cracks. In both cases, the destruction zone was not spherical and had no clearly marked center. Microscopic study indicated that the main energy was not liberated in the focus but along a certain line [sic]. It is assumed that, under the effect of laser beams, transparent plastics change their optical properties and cause the recently observed effect of the "light channel" or self-focusing of the beam (Pilipetskiy, N. F., Rustamov, A. R. ZhETF, 1965, 2, 2, 88). Orig. art. has: 3 figures.

SUB CODE: 11,20/ SUBM DATE: 27Dec65/ ORIG REF: 003/

Card 2/2

ACC NR: AP6033950 SOURCE CODE: UR/0207/66/000/006/0014/0018

AUTHOR: Akimov, A. I. (Moscow); Mirkin, L. I. (Moscow); Pilipetskiy, N. F. (Moscow)

ORG: Institute for Problems of Mechanics AN SSSR (In-t problem mekhaniki AN SSSR); Scientific-Research Institute of Mechanics of Moscow State University (NII mekhaniki MGU)

TITLE: The effect of a laser's light beam on plexiglas

SOURCE: Zhurnal prikladnoy mekhaniki t tekhnicheskoy fiziki, no. 6, 1966, 14-18

TOPIC TAGS: laser radiation, laser effect, plexiglass

ABSTRACT:
A Q-switched laser (pulse length of the order of 10^{-8} sec) and a controlled output power was used in a study of the effect of laser radiation on plexiglas. Destruction was manifested by the formation of microfractures or by the appearance of plane fractures. The type of destruction depended only on the focusing distance of the lens and not on the power of the light beam. The destruction zone had a conical form and consisted of separated dots which dispersed light. The dots concentrated at the beam entrance and near the focal point. With a decrease in focusing distance, the number of micro-fractures diminished and the amount of large fractures increased. Plane fractures also formed when the light pulse of the laser operated in the free

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generation mode (pulse duration 10^{-3} sec). In the case of giant pulses (10^{-8} sec), the fractures usually had a mutual intersection line which coincided with the direction of the laser beam. With a usual pulse (10^{-3} sec), the fractures were inclined to the axis at an angle close to 45°. At a pulse duration of 10^{-3} sec almost all destruction occurred during the pulse action. In the case of giant pulses (10^{-8} sec), the destruction had a conical form and the plane fractures grew after the pulse had stopped. The authors thank G. I. Barenblatt and B. Ye. Zel'dovich for valuable advice and for discussing the results, and V. V. Kireyev, G. F. Kuz'min, and O. Ye. Marin for their help during the experiments. Orig. art. has: 4 formulas, 2 figures, and 1 table.

SUB CODE: 20/ SUBM DATE: 17Jan66/ ORIG REF: 006/ OTH REF: 003/
ATD PRESS: 5113

ACC NR: AP7003261 (A) SOURCE CODE: UR/0207/66/000/006/0125/0128

AUTHOR: Mirkin, L. I. (Moscow); Novikov, N. P. (Moscow)

ORG: none

TITLE: Strengthening of steel in cumulative explosion

SOURCE: Zhurnal prikladnoy mekhaniki i tekhnicheskoy fiziki, no. 6, 1966, 125-128

TOPIC TAGS: shock wave, steel property, metal deformation

ABSTRACT: This work studies the results of reducing the lining of a cumulative depression and the structural changes in the ram material involved. This study ensues from the well-known fact that cumulative explosion forms a cumulative jet which spreads with great velocity at and determines the breakthrough of the obstable and the ram in which the bulk of the lining material reduced in every direction by the explosion products is concentrated. The experiments were conducted with TG50/50 explosive. The charges were 76 mm in diameter and 240 mm high; taper angle of the cumulative depression was 30°. The depression was lined with 0.10% C steel 2.5 mm thick. The charge was ignited from the face opposite the depression. A cumulative jet and ram resulted from the blast. Isosclers resulted from the impact. Microstructural study of the metal shows that it was subjected to high pressures and temperatures. The grain structure shows that the whole material of the ram was subjected to "turbulent" flow in the solid state; the regions between the isosclers were

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ACC NR: AP7003261

evidently first greatly deformed and then rapidly heated. The same effect is observed on impact at 4000 m/sec. The absolute steel hardness values derived in this work are higher than those earlier obtained in pulse deformation; this is probably the result of reduction on all sides. Apparently the dislocations in plastic deformation cannot exit to the interface and there is a higher dislocation density in the metal, leading to great hardening without residual phase transitions. The authors thank B. I. Shekhter and I. M. Gryaznov for their interest in the work and discussion of results and T. M. Aver'yanov for aid in the experiments. Orig. art. has: 6 figures.

SUB CODE: 11, 20/ SUBM DATE: 24May66/ ORIG REF: 008/ OTH REF: 001

Card 2/2

ACC NR: AP7007625 SOURCE CODE: UR/0386/67/005/003/0085/0087

AUTHOR: Barenblatt, G. I.; Vsevolodov, N. N.; Mirkin, L. I.; Pilipetskiy, N. F.; Rayzer, Yu. P.

ORG: Institute of Mechanics Problems, Academy of Sciences, SSSR (Institut problem mekhaniki Akademii nauk SSSR)

TITLE: Destruction of transparent materials by laser radiation. Formation of gas bubbles and wedging of the material by gas pressure

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki. Pis'ma v redaktsiyu. Prilozheniye, v. 5, no. 3, 1967, 85-87

TOPIC TAGS: laser beam, organic glass, beam focusing, laser effect, LASER PHOTOGRAPHY

ABSTRACT: Results are presented of experiments on the damage produced by focused laser radiation in materials of the organic-glass type (polymethylmethacrylate, polystyrene). The results were obtained by photographing the glow due to the focused beam through a lateral surface of the sample, at right angles to the beam direction. The photographs show that the damage is initiated in the form of cracks in the sample, with linear dimensions that grow in a direction opposite that of the beam. These cracks become wedged apart by gas produced as a result of the high temperature near the focused beam. It is proposed that the damage is produced first in the region of the light channel by heat and possibly by hypersound. Minute shear defects are then produced in the planes of maximum tangential stress, which are inclined ~45° to the

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ACC NR: AP7007625

beam axis. Light is further absorbed by the resultant inhomogeneities, the material is evaporated and partially burned, and this gives rise to gas bubbles of high pressure and temperature. The gas pressure produces near the bubbles large stresses and initiates the development of cracks. This development proceeds in the main via wedging of the previously produced shear defects by the gas. This proposed mechanism is confirmed by results of studies of damage in heated samples. Measurements are now under way of the individual parameters of the gas filling the cavity and of its temperature, to permit a more detailed description of the damage mechanism. Orig. art. has: 1 figure.

[02]

SUB CODE: 20/ SUBM DATE: 28Oct66/ ORIG REF: 006/ OTH REF: 002/
ATD PRESS: 5117

Card 2/2